Chapter 7

Potential Mitigation Measures

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7.1. Introduction

The National Environmental Policy Act and its implementing regulations require that EISs identify appropriate mitigation measures for the range of impacts potentially resulting from a proposed action. Mitigation measures are actions that could be taken to avoid, offset, reduce, or compensate for adverse effects to the environment. CEQ guidance specifies that a range of reasonable mitigation measures be identified, even measures that are outside the jurisdiction of the lead agency.

MITIGATION

NEPA defines mitigation as action taken to avoid, reduce the severity of, or eliminate an adverse impact. Mitigation can include:

- Avoiding impacts;
- Minimizing impacts by limiting the degree or magnitude of the action;
- Restoring or rehabilitating the affected environment;
- Reducing or eliminating impacts over time; and,
- Compensating by providing offsetting resources or environments.

The purpose of this chapter is twofold: it recognizes TVA's responsibility to identify a range of mitigation actions that could be undertaken depending on the decisions TVA makes, and the chapter describes the programmatic framework within which mitigation measures could be implemented.

At this stage of the evaluation process, only broad categories of mitigation for certain types of impacts can be addressed and the possible ways in which they might be implemented can be described. After considering public comments on mitigation measures, and appropriately revising and issuing a Final EIS, TVA will identify those mitigation measures it chooses to implement in its Record of Decision for this action.

Because the ROS is a programmatic action that takes place over a multi-state region, TVA's mitigation approach also is programmatic. Mitigation strategies rely heavily on TVA's existing resource management programs to implement identified mitigation measures and to detect and track environmental changes that may occur.

The remainder of this chapter is organized into three parts. The first part describes the need and context for a programmatic approach to mitigation. The second part presents an overview of TVA's management programs, which provide a framework for mitigation, monitoring, reporting, and enforcement. The third part provides some specific examples, by resource area, of how appropriate categories of mitigation would be identified and evaluated.

7.2. Programmatic Approach to Mitigation

Mitigation for a policy action differs considerably from mitigation for a specific project. This is especially true for an operations policy that affects a geographic area and the number of waterbodies the size of the TVA reservoir system. In contrast with project-specific impacts, which may be readily delineated and quantified, policy impacts can be diffuse, difficult to predict, may or may not occur as anticipated, and may be manifested over a long period of time. The prediction of environmental impacts, always an inexact science, is even more difficult for large-scale actions such as reservoir operations. Consequently, monitoring and an adaptive response are necessary components of a programmatic mitigation plan.

Over the years, TVA's changes to its reservoir operations reflect an adaptive response that has included substantial monitoring of environmental parameters, evaluation of ongoing environmental impacts, and systematic mitigation for large-scale impacts. An example is TVA's RRI Program. Under this program, TVA has restored levels of DO in over 300 miles downstream of 16 projects. Implementation of this program was completed in 1996, but ongoing operational activities could be used to mitigate any increases in problems with low DO in project releases.

In addition, the numerous federal statutes, implementing regulations, and executive orders presented in Chapter 4, Description of Affected Environment, can substantially affect the impacts relating to reservoir operations policies. Chapter 5, Environmental Consequences of the Alternatives, provides the impact analysis and conclusions concerning compliance with these regulations and statutes; these are summarized in this chapter, as appropriate. Relative to state and local jurisdictions within the ROS study area affecting the impacts of reservoir operations policy alternatives, TVA was not able to review the extremely large number of individual state and local plans and laws that may be applicable. Based on the orientation and typically limited applicability of state and local authorities to federal multi-purpose projects, however, TVA assumed that the proposed action would generally be consistent with state and local plans and laws. Because most local planning ordinances primarily establish restrictions for development and growth in areas, local ordinances would generally not be applicable to the reservoir system operating policy alternatives or other ROS actions.

State and local agencies manage a variety of recreation, infrastructure, and related resources along the river system. Impacts on these resources that could result from the various policy alternatives are identified in Chapter 5, Environmental Consequences of the Alternatives. This chapter summarizes potential mitigation measures for the impacts identified in Chapter 5.

TVA has developed numerous policies and programs to protect and enhance natural resources; these programs are the logical institutional framework for implementing mitigation actions. As impacts are identified, changes to existing TVA programs could be made to address impacts.

7.3. TVA Management Programs—Providing a Framework for Mitigation

TVA presently manages and administers a wide variety of programs, initiatives, public outreach, and other individual measures designed to monitor, protect, maintain, and enhance the quality of the natural and human environment within the TVA reservoir system (Table 7.3-01). These range from monitoring programs such as the Vital Signs Reservoir Ecological Health Monitoring Program, to the development of LMPs, and the implementation of the Clean Water Initiative.

Table 7.3-01 TVA Program Elements and Activities Relevant to Mitigation

TVA Program or Activity	TVA Programs and Activities Relevant to Mitigation Strategies
Section 26A Permitting Process–Requires obtaining TVA approval before carrying out construction activities along the shoreline of TVA projects	• This program addresses construction, maintenance, and operation of facilities and activities on, over, or along the Tennessee River and its tributaries. This includes residential shoreline structures, non-navigable houseboats, and intakes and outfalls. • The 11 Watershed Teams are responsible for the implementation of Section 26a. These Teams, among other responsibilities, oversee and coordinate the land use planning and management of one or more TVA reservoirs within a defined region. • Permit recipients are required to follow the construction procedures and environmental protection measures specified. • For non-routine projects or actions, Environmental Assessments (EAs) or Environmental Impact Statements (EISs) are completed in addition to the Section 26A permitting process.
Reservoir Land Management Planning–Defines allowable areas for residential, commercial, and industrial shoreline development on TVA property	• Land Management Plans (LMPs) are approved by the TVA Board of Directors and implemented by the Watershed Teams. • Each plan includes provisions for shoreline management, land use, protection, and monitoring. The whole reservoir is considered in the plan. • Each LMP includes an EA or EIS, subject to National Environmental Policy Act (NEPA) regulations and extensive interagency and public review.
Reservoir Release Improvements Program– Elements from the RRI Program, completed in 1996, to improve dissolved oxygen (DO) and increase water levels in tailwaters from minimum flows	• TVA uses a wide range of methods to improve DO levels. In some cases, more than one approach is necessary to reach oxygen targets (6 milligrams per liter of water in cold-water streams below dams with minimal inflows of watershed pollutants, and 4 milligrams per liter in warm-water streams below dams with significant inflows of pollutants), which include turbine venting, surface water pumps, oxygen injection systems, aerating weirs, and air compressors and blowers. • TVA uses three different technologies to increase water levels in the riverbed below tributary dams when hydroelectric generation is shut off, including turbine pulsing, weirs, and small hydroelectric units.

Table 7.3-01 TVA Program Elements and Activities Relevant to Mitigation (continued)

TVA Program or Activity	TVA Programs and Activities Relevant to Mitigation Strategies
Vital Signs Reservoir Ecological Health Monitoring Program–TVA's program to systematically monitor the ecological condition of its reservoirs	• This monitoring program provides the necessary information from five key indicators (chlorophyll, DO, fish assemblage, benthic macroinvertebrates, and sediment contaminants) to evaluate conditions in reservoirs and to target detailed assessment studies if significant problems are found. In addition, this information establishes a baseline for comparing future water quality conditions in TVA's reservoirs. • TVA monitors ecological conditions at 69 sites on 31 reservoirs. Each site was monitored initially for 4 to 5 consecutive years to establish baseline data. Monitoring continues on an every-other-year basis unless a substantial change in the ecological health score occurs during a 2-year cycle. If that occurs, the site is monitored the next year to confirm that the change was not temporary. Roughly half the sites are sampled each year on an alternating basis. • Physical and chemical water quality monitoring is conducted monthly from April through September on mainstem reservoirs and from April through October on tributary reservoirs. Sampling includes temperature, DO, pH, and conductivity profiles, and photic zone composite samples for chlorophyll and nutrients (TotalP, NH3, NOx, organic N, TKN, TSS, and TOC). In 1999, TVA began physical and chemical water quality monitoring annually on 32 reservoirs at 59 locations. • The reservoir fish and benthic assemblages are sampled once in late fall/early winter. The condition of these biological communities is evaluated using multi-metric indices. Sediment samples are collected in July or August of each year and analyzed for PCBs, pesticides, and metal contaminants. Biological sampling (fish and/or benthic macroinvertebrates) of tailwaters will be conducted annually for 17 tailwaters at 46 sites. The monitoring program is based on sampling protocols following the Level III fish and Level III benthic bioassessment protocols.
Shoreline Management Policy–A comprehensive management policy developed out of the Shoreline Management Initiative that provides construction and land use standards for residential development along TVA reservoir shorelines	• The 11 Watershed Teams are responsible for implementation of the Shoreline Management Policy. • The goal is to balance shoreline development, recreation use, and resource conservation needs. • The policy promotes the use of best management practices for the construction of docks, management of vegetation, stabilization of shoreline erosion, and other shoreline alterations. • New construction on waterbodies is limited to 1,000 square feet. • Shorelands not open for development can be opened only if offset by closing other open shorelands to development (a maintain-and-gain policy). • A 50-foot shoreline management zone (or greenbelt) is retained on TVA land that adjoins newly developed residential areas.

Table 7.3-01 TVA Program Elements and Activities Relevant to Mitigation (continued)

TVA Program or Activity	TVA Programs and Activities Relevant to Mitigation Strategies
Shoreline Management Policy (continued)	• Under this policy, a Residential Access Shoreland Inventory is being conducted, which includes an ongoing baseline inventory of resource conditions along TVA-owned residential access shoreland and flowage easement shoreland. Residential shoreline is placed into at least three categories: shoreline protection, residential mitigation, and managed residential. • Vegetation Management Plans are required for new developments under this policy and are designed to improve or enhance the vegetative cover of the property. Use of native vegetation is encouraged. • Best management practices for the construction of docks, management of vegetation, stabilization of shoreline erosion, and other shoreline alterations are promoted to protect water quality.
Shoreline Treatment Program–A program for rating the condition of shorelines within TVA reservoirs and identifying those to be restored through stabilization and revegetation	• TVA has conducted Shoreline Condition Assessments on all TVA reservoir shorelines. These assessments rate the shoreline conditions based on two parameters: erosion condition and vegetation condition. Shorelines are rated as good, fair, or poor based on the combined score for the two parameters. Each year, TVA has selected 35 to 40 sites (approximately 8 miles of reservoir shoreline), rated as poor, to be restored through stabilization and revegetation. The shoreline rating criteria, used to rank potential sites in order of treatment priority, provides a higher rating to those sites where archaeological resources are threatened, all other criteria being equal.
Hydro Modernization and Hydro Automation Programs–TVA Programs to update key turbine units at reservoirs and automate the control of TVA's hydropower generating units	• The purpose of the Hydro Modernization (HMOD) Program is to provide for a safer and more reliable hydropower system, improved operational efficiency, and increases in system capacity at an acceptable economical cost and return to TVA by replacing key turbines at reservoir dams. HMOD projects are planned for 92 turbines at 26 reservoirs. Forty projects have been completed to date. • The Hydro Automation Program will link all 109 units to a centralized computer system so turbines can be managed on a system-wide scale rather than individually.

Table 7.3-01 TVA Program Elements and Activities Relevant to Mitigation (continued)

TVA Program or Activity	TVA Programs and Activities Relevant to Mitigation Strategies
TVA Natural Areas Program– TVA's cooperative management of publicly owed lands	• In managing the publicly owned land in and around its facilities and reservations, TVA has developed a land use designation system under which 82 sites on 10,700 acres have been classified as TVA natural areas. The sites are identified as habitat protection areas, small wild areas, ecological study areas, or wildlife observation areas. Their management includes restrictions on activities that might endanger significant natural features.
Natural Heritage Project– TVA's database on geological features, natural areas, and other sensitive natural resources	• The project conducts fieldwork aimed at protecting threatened and endangered species and environmentally sensitive sites. In addition, it maintains databases on geological features, natural areas, and other sensitive natural resources. Since its inception, the Natural Heritage Project has provided environmental input on TVA activities that range from transmission line construction to economic development.
Riparian Restoration–A program element to protect and restore riparian vegetation	• Riparian restoration is designed to help owners of streambank or shoreline properties create landscaping plans that not only enhance their property but also protect water resources. The program identifies ways of using trees and other vegetation to help reduce erosion by holding soil in place, protect water quality by filtering sediments and pollutants, provide wildlife habitat and cover for fish, and create scenic beauty along the water's edge.
Cultural Resources Management–TVA's program to manage cultural and archaeological resources	• Cultural resources management includes various actions to address requirements of the National Historic Preservation Act and the Archaeological Resource Protection Act. • Archaeological resources in need of treatment/protection are identified from data obtained during archaeological surveys of reservoir shorelines and TVA reservoir lands, and through additional field evaluations of site conditions. The most critically impaired sites are submitted to the Shoreline Treatment Program for consideration in that program's rating process. For each site selected for treatment, consultation is conducted with the appropriate State Historic Preservation Office and other stakeholders, such as Indian tribes.

Table 7.3-01 TVA Program Elements and Activities Relevant to Mitigation (continued)

TVA Program or Activity	TVA Programs and Activities Relevant to Mitigation Strategies
Clean Water Initiative–A program started in 1992 as a result of the Lake Improvement Plan; TVA partnerships with community residents, businesses, and government agencies to promote watershed protection	• TVA'S Watershed Teams are responsible for carrying out the program. They focus on improving water and shoreline conditions so that people and aquatic life can benefit from clean water. Among other accomplishments, these community coalitions have: —Instituted agricultural and urban management practices that reduce water pollution; —Treated eroded land and stabilized streambanks; —Planted vegetation and installed structures intended to improve aquatic habitat; and, —Collected waste and litter from streambanks and shores.

Each of these natural resource management and protection programs has been developed as a result of a clearly defined need—as defined by environmental conditions, public perceptions and comments, and collaboration with other federal and state agencies. These programs were put into place after considerable review and public input, and they each have clear mechanisms for completing environmental review, public outreach, and sharing results to solicit public feedback and comments. The RRI Program and the Clean Water Initiative, both highly successful programs, were initiated soon after the Lake Improvement Plan and EIS (TVA 1990). In a similar manner, TVA anticipates that it would implement mitigation measures following the ROS within the context of these existing programs whenever possible. Because these management plans and processes are well established by TVA and well known to the public, they would be the most obvious and effective mechanisms for implementing many of the mitigation measures discussed in this chapter.

Table 7.3-01 outlines a number of TVA program elements and activities relevant to mitigation. These elements and activities are referenced in the following sections, and the types of mitigation measures that may best fit into certain programs are identified in the following section.

7.4. Potential Impacts and Mitigation by Policy Alternative Formulation

Mitigation follows a sequence of first avoiding impacts; minimizing impacts by limiting the degree or magnitude of the action; and then, if needed, by restoring or rehabilitating the affected environment, reducing or eliminating impacts over time, or compensating by providing offsetting resources or environments.

Through the alternative formulation process, TVA has been implementing the first steps of mitigation by avoiding and minimizing potential impacts in the design of its reservoir operations policy alternatives. Implementation of any operations policy, including the Base Case, would result in some environmental impacts. TVA will continue to explore ways to avoid and minimize impacts through the development and refinement of alternatives during the completion of the EIS, and will consider agency and public input during that process.